Appl. No 10/587,850 Amdt. dated March,05 2009   Reply to Office Action Feb 12. 2009

Claims

1 (Canceled)

2 (Currently amended):   Complex polarizer system for reciprocal polarization (cross-
polarizer) according to claim 29 30,
said polarization layers Pi being cartesian polarizers, and said polarization layers
Pi being arranged in planes which are perpendicular to a common ground plane,
and all said optical axes being coplanar to a common ground plane.

3 (Previously presented): Complex polarizer system for reciprocal polarization (cross-
polarizer) according to claim 2,
said polarizing layer vector V1 of P1 and said polarizing layer vector V2 of P2
being perpendicular to each other.

4 (Previously presented): Complex polarizer system for reciprocal polarization (cross-
polarizer) according to claim 3,
said polarizing layers P2 and P3 forming a common polarization layer.

5 (Currently amended):   Complex polarizer system for reciprocal polarization (cross-
polarizer) according to claim 29 30, comprising
at least one right triangular prism composed of two right prisms T1 and T2 each
with an isosceles triangular base;
the lateral surface of sub-prism T2 in-between the two sub-prisms carrying a
cartesian polarization layer P1;
the lateral surface of sub-prism T1, which together with a lateral surface of sub-
prism T2 forms a common lateral surface of said composed prism, carrying a
cartesian polarization layer P2.

6 (Currently amended):   Complex polarizer system for reciprocal polarization (cross-
polarizer) according to claim 29 30, comprising
a right prism with an isosceles triangular base;
the two lateral surfaces of equal size of said prism carrying mutually
complementary polarizations layers.

7 (Currently amended):   Complex polarizer system for reciprocal polarization
(cross-polarizer) according to claim 29 30,
comprising an additional fourth polarization layer P4 which together with said P2

and with said P3 constitutes an additional cross-polarizer according to claim +
<u>30</u>.

8 (Previously presented):   Complex polarizer system for reciprocal polarization
   (cross-polarizer) according to claim 7,
   polarization layers P1 and P4 having parallel polarizing layer vectors and being
   coplanar, and the polarization layers P2 and P3 having parallel polarizing layer
   vectors and being coplanar, and all four layers having an intersection line.

9 (Withdrawn):   Complex polarizer system for reciprocal polarization (cross-
   polarizer) comprising
   at least two polarizing layers Pi (i=1,2,..);
   said Pi characterized by a normal vector Ni normal to Pi and a polarizing layer
       vector Vi coplanar to Pi;
   said Pi having beam splitting properties, which split an incident beam into a
       transmitting and a reflected beam;
   said Vi and the reflected beam spanning the plane of polarization of the reflected
       beam;
   said Vi and the transmitting beam spanning a plane perpendicular to the plane of
       polarization of the transmitting beam;
   P1 and a further polarizer being arranged along a first optical path S1 such that
       the plane E1 is spanned by V1 and the optical axis of S1 in P1, and the plane
       E2 is spanned by the polarizing layer vector of said further polarizer and the
       optical axis of S1 in said further polarizer;
   said two polarizing layers being mutual complementary, characterized by
   the plane E1*, derived from E1 by optional means for folding, being
       perpendicular to E2;
   P1 and a further polarizer being arranged along a second optical path S2 such
       that the plane E3 is spanned by V1 and the optical axis of S2 in P1, and a
       plane E4 is spanned by the polarizing layer vector of said further polarizer
       and the optical axis of S2 in said further polarizer;
   said two polarizing layers being mutual complementary, characterized by the
       plane E3*, derived from E3 by optional means for folding, being
       perpendicular to E4;
   said two optical paths S1 and S2 intersecting in P1 with equal cutting angles
       between N1 and S1 and between N1 and S2;
   the architecture of the system coupling the transmission at P1 to a reflection at the

further polarizer along S1 and the corresponding reflection at P1 to a transmission at the further polarizer along S2.

10 (Withdrawn):   Complex polarizer system for reciprocal polarization (cross-polarizer) comprising

at least three polarizing layers P_i (i=1,2,3,..);

said P_i characterized by a normal vector N_i normal to P_i and a polarizing layer vector V_i coplanar to P_i;

said P_i having beam splitting properties, which split an incident beam into a transmitting and a reflected beam;

said V_i and the reflected beam spanning the plane of polarization of the reflected beam;

said V_i and the transmitting beam spanning a plane perpendicular to the plane of polarization of the transmitting beam;

P1 and P2 being arranged along a first optical path S1 such that the plane E1 is spanned by V1 and the optical axis of S1 in P1, and the plane E2 is spanned by V2 and the optical axis of S1 in P2;

said polarizing layers P1 and P2 being mutual complementary, characterized by

the plane E1*, derived from E1 by optional means for folding, being perpendicular to E2;

P1 and P3 being arranged along a second optical path S2 such that the plane E3 is-spanned by V1 and the optical axis of S2 in P1, and a plane E4 is spanned by V3 and the optical axis of S2 in P3;

said polarizing layers P1 and P3 being mutual complementary, characterized by the plane E3*, derived from E3 by optional means for folding, being perpendicular to E4;

said two optical paths S1 and S2 intersecting in P1 with equal cutting angles between N1 and S1 and between N1 and S2;

the architecture of the system coupling the transmission at P1 along S1 to a reflection at P2 and the corresponding reflection at P1 to a transmission at P3 along S2.

11 (Withdrawn):   Complex polarizer system for reciprocal polarization (cross-polarizer) according to claim 10,

comprising an additional fourth polarizing layer P4, which together with said P2 along a third optical path S3 and together with said P3 along a fourth optical path S4 constitutes an additional cross-polarizer according to claim 10.

12 (Currently amended):   Complex polarizer system for reciprocal polarization
(cross-polarizer) according to claim 29 30,
at least one of said layers Pi being a doubled or two-sided cartesian polarizer with
parallel layer vectors Vi.

13 (Currently amended):   Complex polarizer system for reciprocal polarization
(cross-polarizer) according to claim 29 30,
all of said Pi being cartesian polarizers, e.g. wire grid polarizers.

14 (Currently amended):   Complex polarizer system for reciprocal polarization
(cross-polarizer) according to claim 29 30,
all of said Pi being thin-film polarizers of the MacNeille type.

15 (Currently amended):   Complex polarizer system for reciprocal polarization
(cross-polarizer) according to claim 29 30,
all of said Pi being contained in a body and the optical paths into and out of the
cross-polarizing system being made possible by windows or openings.

16 (Currently amended):   Complex polarizer system for reciprocal
polarization (cross-polarizer) according to claim 29 30, further comprising
at least two spatial light modulators;
said polarizer system being used to feed the spatial light modulators with
polarized light.

17 (Currently amended):   Complex polarizer system for reciprocal polarization
(cross-polarizer) according to claim 29 30, further comprising
at least two spatial light modulators;
said polarizer system being used to superpose the modulated light from the spatial
light modulators.

18 (Currently amended):   Complex polarizer system for reciprocal
polarization (cross-polarizer) according to claim 29 30, further comprising
at least two spatial light modulator of the type micro-electro-mechanical-system
(MEMS, e.g. DMD by Texas Instruments);
said polarizer system being used to feed the spatial light modulators with
polarized light and to superpose the modulated light from the spatial light

modulators.

19 (Withdrawn):   Complex polarizer system for reciprocal polarization (cross-
       polarizer) according to claim 9, further comprising at least one spatial light
       modulator positioned in said optical paths S1 and S2 between P1 and P2.

20 (Previously presented):   Complex polarizer system for reciprocal polarization
       (cross-polarizer) according to claim 15, further comprising at least one spatial light
       modulator which is mounted to the body.

21 (Currently amended):   Complex polarizer system for reciprocal polarization
       (cross-polarizer) according to claim ~~29~~ 30,
       comprising at least one right triangular prism;
       said prism being composed of two right triangular sub-prisms with the base of an
           isosceles triangle each, with a thin-film type polarizing layer P1 with its layer
           vector V1 being situated between these two sub-prisms;
       the lateral surface of the compound prism which consists of two lateral surfaces of
           the sub-prisms carrying a cartesian polarizing layer P2 with its layer vector
           V2;
       V2 being perpendicular to V1.

22 (Currently amended): Complex polarizer system for reciprocal polarization (cross-
       polarizer) according to claim ~~29~~ 30,
       comprising at least one right triangular prism;
       said prism being composed of two right triangular sub-prisms with the base of an
           isosceles triangle each, with a cartesian type polarizing layer P1 with its layer
           vector V1 being situated between these two sub-prisms;
       the lateral surface of the compound prism which consists of two lateral surfaces of
           the sub-prisms carrying a cartesian polarizing layer P2 with its layer vector
           V2.

23 (Currently amended):   Complex polarizer system for reciprocal polarization
       (cross-polarizer) according to claim ~~29~~ 30, comprising
       at least one right triangular prism;
       said prism being composed of two right triangular sub-prisms T1a, T1b with the
           base of an isosceles triangle each;

those lateral surfaces of the compound prism, which consist of only one lateral surface of the sub-prisms carrying polarization layers P1 and P2.

24 (Currently amended):   Complex polarizer system for reciprocal polarization (cross-polarizer) according to claim ~~29~~ 30, comprising
at least one right triangular prism;
said prism being composed of two right sub-prisms with the base of an isosceles triangle each;
a thin-film type polarizing layer P1 being situated between these two sub-prisms.

25 (Currently amended): Complex polarizer system for reciprocal polarization (cross-polarizer) according to claim ~~29~~ 30,
all cartesian polarizing layers being doubled or two-sided.

26 (Currently amended):   Method of using a cross-polarizer according to claim ~~29~~ 30.

27 (Withdrawn - currently amended): Method for reciprocal polarization (cross-polarization),
using a light source;
using three polarization beam splitting layers Ptrans1refl, with a polarizing layer vector Vtrans1refl, Pref2, with a polarizing layer vector Vref2, and Ptrans2, with a polarizing layer vector Vtrans2;
using the optical axis Atrans1 and the optical axis Arefl which is derived from Atrans1 by mirroring Atrans1 at the plane of Ptrans1refl;
using a polarized beam Btrans1ref2, which transmits Ptrans1refl along Atrans1; ~~located between Ptrans1refl;~~
using a polarized beam Brefltrans2, which is reflected at Ptrans1refl along Arefl;
arranging Btrans1ref2 and Brefltrans2 such that they form a common beam with both polarization components of Btrans1ref2 and Brefltrans2 on one side of Ptrans1-refl;
choosing Vtrans1refl such that the plane of polarization of Btrans1ref2 is perpendicular to the plane spanned by Vtrans1refl and Atrans1, and that the plane of polarization of Brefltrans2 is spanned by Arefl and Vtrans1refl;
guiding Btrans1ref2 on an optical path between Ptrans1refl and Pref2;
arranging Pref2 such that the optical path of Btrans1ref2 leads to Pref2 in the optical axis Aref2;

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arranging Pref2 such that Btrans1ref2 is reflected at Pref2 by choosing Vref2 such that
the plane of polarization of Btrans1ref2 is spanned by Aref2 and Vref2,
therefore coupling the transmission of Btrans1ref2 at Ptrans1ref1 to a reflection of
Btrans1ref2 at Pref2;

guiding Brefltrans2 on an optical path between Ptrans1ref1 and Ptrans2;

arranging Ptrans2 such that the optical path of Brefltrans2 leads to Ptrans2 in the
optical axis Atrans2;

arranging Ptrans2 such that Brefltrans2 transmits Ptrans2 by choosing Vtrans2 such that
the plane of polarization of Brefltrans2 is perpendicular to the plane spanned
by Atrans2 and Vtrans2, therefore coupling the reflection of Brefltrans2 at
Ptrans1ref1 to a transmission of Brefltrans2 at Ptrans2.

28 (Withdrawn):   Method for reciprocal polarization (cross-polarization),
using a light source;
using four polarization beam splitting subprocesses (either a polarizing
transmission or a polarizing reflection at a polarizing beam splitting layer)
Ptrans1, Pref1, Pref2, Ptrans2;
using a polarized beam Btrans1ref2, transmitting at the process Ptrans1;
using a polarized beam Brefltrans2, which is reflected at Pref1;
said Ptrans1 and Pref1 subprocesses being the polarizing transmission subprocess
and polarizing reflection subprocess of a common polarization split process;
sending Btrans1ref2 through the polarizing reflection subprocess Pref2, thus coupling
the polarizing transmission Ptrans1 of Btrans1ref2 to the polarizing reflection
Pref2 of Btrans1ref2;
sending Brefltrans2 through the polarizing transmission subprocess Ptrans2, thus
coupling the polarizing reflection Pref1 of Brefltrans2 to the polarizing
transmission Ptrans2 of Brefltrans2.

29 (Withdrawn):   Complex polarizer system for reciprocal polarization (cross-
polarizer), comprising an arrangement of
three polarizing beam splitting layers Pi (i=1,2,3);
the position of each of said Pi described by its unit normal vector Ni and its
position vector Li;
the polarization beam splitting characteristics of Pi described by a polarizing
layer vector Vi coplanar to Pi such that light incident on Pi in Li along an
arbitrary incidence vector Ti is split into a transmitted beam with the plane of

polarization trans-POP: $((T_i \times V_i) \times T_i) \circ (\mathcal{X} - L_i) = 0$, and a reflected beam

(the according reflection vector being described by $R_i = T_i - 2(T_i \circ N_i)N_i$) with

the plane of polarization ref-POP: $(R_i \times V_i) \circ (\mathcal{X} - L_i) = 0$, with $(a \circ b)$

being the scalar product of the two vectors a and b and with $(a \times b)$ being
the cross product of the two vectors a and b;
one axis, described by axis vector A1 and said L1;
P1 and A1 defining
the axis vector A2, which is A1 reflected on P1 in L1,
$[A2 = A1 - 2(A1 \circ N1)N1]$;

the plane E1 $[(V1 \times A1) \circ (\mathcal{X} - L1) = 0]$;

the plane E3 $[(V1 \times A2) \circ (\mathcal{X} - L1) = 0]$;

P2 being arranged relative to said P1 and said A1 such that

plane E2 $[(V2 \times A1) \circ (\mathcal{X} - L2) = 0]$ is perpendicular to plane E1

$[L2 = L1 + d2^* A1; (V2 \times A1) \circ (V1 \times A1) = 0]$;
P3 being arranged relative to said P1 and said A2 such that

plane E4 $[(V3 \times A2) \circ (\mathcal{X} - L3) = 0]$ is perpendicular to plane E3

$[L3 = L1 + d3^* A2; (V3 \times A2) \circ (V1 \times A2) = 0]$.

30 (previously presented):   Complex polarizer system for reciprocal
polarization (cross-polarizer), comprising an arrangement of
three polarizing beam splitting layers Pi $(i=1,2,3)$;
the polarizing beam splitting characteristics of said Pi being described by a
polarizing layer vector Vi coplanar to Pi such that linearly polarized light
incident on Pi is maximally reflected if its plane of polarization is coplanar to
Vi;
positioning said three layers such that there exists at least one position vector Li
pointing to a point in each Pi so that

$[V2 \times (L2-L1)] \circ [V1 \times (L2-L1)] = 0$ (coupling of P1 and P2);

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$$[V3 \times (L3-L1)] \circ [V1 \times (L3-L1)] = 0 \qquad \text{(coupling of P1 and P3);}$$

$$k (L3-L1) = (L2-L1) - 2 [(L2-L1) \circ N1] N1 \qquad \text{(coupling of the two couplings);}$$

with N1 being the unit normal vector of P1, and (a ∘ b) being the scalar product of the two vectors a and b, and (a × b) being the cross product of the two vectors a and b.